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Eugymnanthea japonica (Hydrozoa, Eirenidae) spawns by illumination of red light

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Abstract. Ephemeral mature medusa of a bivalve-inhabiting hydrozoan *Eugymnanthea japonica* Kubota (Eirenidae) can be spawning even under the illumination of red light as well as room light. Spawning is induced also by both blue and yellow light.

Key words: bivalve-inhabiting hydrozoan, *Eugymnanthea*, medusa, LED, red light, spawning

Introduction

The release of an ephemeral medusa from a polyp and successive spawning of a mature medusa at certain specific time of a day in the sea are ecologically and reproductively meaningful events even evolutionally (Genzano and Kubota, 2003; Kubota, 1996, 1997, 2000, 2004, 2012). The life spans of such abortive medusae are very short and sexual reproduction is carried out only once in their life (Yoshida, 1954; Kubota, 1991). In the present study, for the first time a red light illumination is tested to induce spawning of *Eugymnanthea japonica* Kubota since it is well known that red light is absorbed in the sea surface (Gross and Gross, 1996) and that many marine animals are insensitive to this wave length like corals. Furthermore other color lights are tested for spawning of this species, particularly blue light.

Materials and Methods

A total of 94 female mature medusae of *Eugymnanthea japonica* Kubota were obtained in the lab-

oratory several hours after collection of polyps at 17:00-19:00 (before sunset) on October, 31, 1995 (cf. Kubota, 1993, 1994). Their polyps are associated with several host specimens of *Mytilus galloprovincialis* attached to the buoys of a raft at Shirahama, Wakayama Prefecture, Japan. Filling filtered natural seawater (1.8 cc, ca 32 psu) at Shirahama in each hole of a well-plate, put one individual mature medusa in it immediately, and the well-plate transferred to the dark room for 12 or 18 hours at 22°C. On the next day at 8:05 -14:10, in that dark room LED red light (ca 633+20 nm, ca 20 lux measured by Lux Meter LM-230 AS ONE CORPORATION) was illuminated very near the well-plate and behavior of medusa was observed every 5 minutes until spawning takes place under a stereoscopic microscope. Control observation was made in the same way under the natural light conditions (conducted at 14:30).

The same observations were carried out preliminarily, again using Shirahama *Eugymnanthea* populations that collected among plankton samples in summer of 2013 (5♀+2♂ on July 26 & Aug. 8) in the Tanabe Bay. On this occasion in both the female and male mature medusae the same tests were conducted by not only red but also blue and yellow LED lights.

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Table 1. Spawning of medusae of *Eugymnanthea japonica* by illumination of red LED light and room light (control).

Duration of dark treatments (hr.)	Time after illumination (min.)	Spawning rate (%), number of medusae examined, time of the day
12	25	59.4, 32* (8:05)
12	30	100, 32* (8:10)
18	25	63.3, 30** (14:05)
18	30	100, 30** (14:10)
18 (control)	45	100, 32 (14:30)

*, **: each mark shows same specimens examined in different time

Results and Discussion

In laboratory, all the female medusae of *Eugymnanthea japonica* (<24 hour-old after release from their polyps) were successively spawning all eggs (120-130 in number) within 30 minutes after red light illumination as well as that was illuminated of natural room light (control) in both cases of 12 or 18 hours dark treatment at 22°C (Table 1). Spawning were finished only several minutes as described before (Kubota, 2012) by active swimming of medusa at the spawning occasion.

All the results of the present observations other than the red light are the same as the previously obtained results under the natural light (Kubota, 2012). Therefore, it can be concluded that *Eugymnanthea japonica* mature medusa spawns eggs normally by red, blue, and yellow light illumination. However, it is not known what part(s) of body is equipped such light sensor(s) in this ephemeral *Eugymnanthea* medusa that has no eye-spot.

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